HIGH-GRADE SARCOMAS MIMICKING TRAUMATIC INTRAMUSCULAR HEMATOMAS: A REPORT OF THREE CASES

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ABSTRACT

We reported on three patients with high-grade soft-tissue sarcomas mimicking traumatic intramuscular hematomas. Patients had an episode of trauma to the extremity, and after initial clinical and imaging evaluations they were considered to have muscular hematomas. The lesions increased in size over time, leading to further evaluations that demonstrated the actual diagnosis. We conducted a retrospective review of the clinical findings, magnetic resonance images, and computed tomography scans to assess characteristics that will help in the differential diagnosis.

We conclude that intramuscular hematomas following trauma should be approached with a high degree of clinical suspicion. MRI analysis can be used as an important diagnostic tool, but the results must be seen in the context of the clinical history. MRI is not sensitive or specific enough to rule out malignancy. The diagnosis of a high-grade sarcoma must be considered in these patients and any doubt should be resolved with a biopsy.

INTRODUCTION

Sarcomas comprise approximately one percent of malignant tumors and represent a significant diagnostic and therapeutic challenge.[14] The incidence of soft-tissue sarcomas in the United States ranges from 20 to 30 per 1,000,000 persons, approximately 6,000 new cases per year.[13] Soft-tissue sarcomas are a heterogeneous group of tumors that arise from tissue of mesenchymal origin and are characterized by infiltrative local growth. The metastatic spread of sarcomas is mainly hematogenous to the lungs, although lymphatic spread may occur. Soft-tissue sarcomas can occur at any site throughout the body.[5] Almost 45 percent of all soft tissue sarcomas are found in the extremities, especially in the lower limb.[15]

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Patients usually present with a complaint of a lump or growth, with or without pain. However, there are some instances in which the patient will present after moderate trauma to the extremity. These cases are very challenging since the injury symptoms and imaging studies could mask the underlying tumor. We present the cases of three patients with high-grade sarcomas who initially suffered moderate traumas to their extremities and were initially diagnosed with intramuscular hematomas by clinical and imaging studies.

CASE REPORTS

Case 1

A 53-year-old white female fell on the lateral aspect of her right thigh while working. The next morning she noticed discomfort in the medial aspect of her thigh, near the groin area. She consulted a local family physician who diagnosed a “pulled muscle” and treated her with pain medication and local heat. This treatment protocol did not relieve her discomfort and she consulted again four days later. At that time, clinical examination demonstrated pain to palpation and slight swelling of the upper medial thigh without evidence of soft-tissue mass. Continuation of the same treatment was recommend.

Five weeks later the patient worsened and a radiograph and a CT scan of the thigh were ordered. The CT was reported as showing a bulky mass involving all adductor magnus compartments, suspicious for an organized hematoma without clear evidence of ossification or calcification. An MRI was then ordered which was read as showing a 6 x 8 centimeter soft-tissue mass partially replacing the adductor musculature proximally and medially, with moderately high T2 signal and generally low T1 signal with scattered areas of increased signal intensity. This MRI was interpreted as a sub-acute hematoma (Figure 1). A vascular Doppler study to rule out an aneurysm was performed and interpreted as normal. Resting and local heat were again recommended, but there was no improvement in the pain or swelling.

Symptoms continued to worsen and the pain became uncontrollable even with morphine administration. The patient consulted again and was then referred to radiology for angiography, which demonstrated a highly vascularized mass with malignancy characteristics. Four

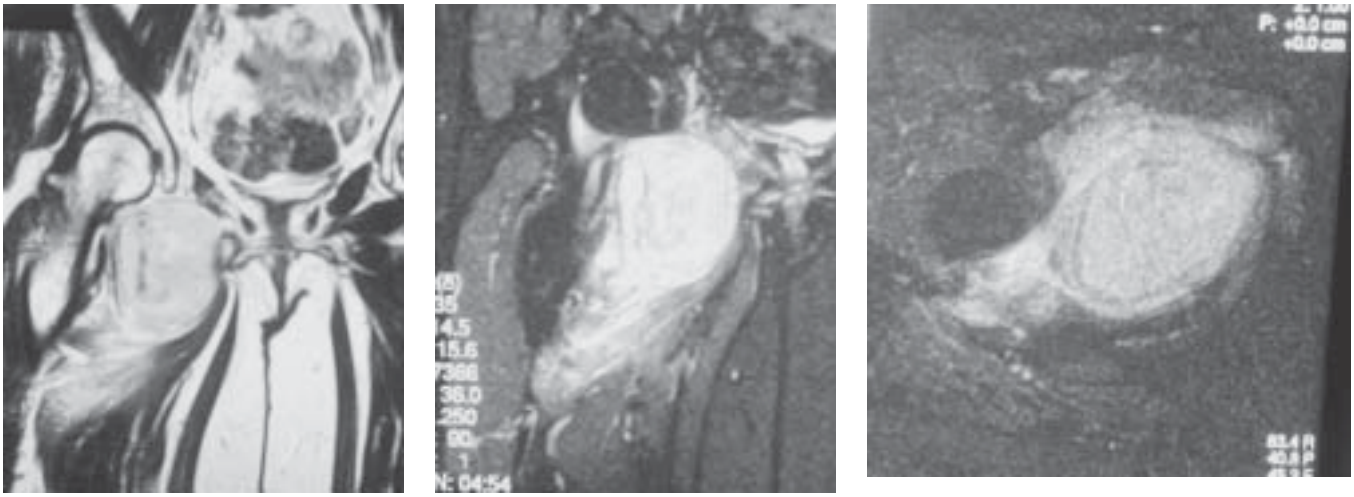

Figure 1. MRI coronal and axial images of the upper thigh—note a 6x8 centimeter soft tissue mass in the medial aspect of the upper thigh, replacing part of the adductor musculature, in contact with the hip joint capsule and obturator foramen. It shows moderately high T2 signal, with low T1 signal, and scattered areas of increased T1 signal. The mass is well circumscribed and there is edema in the musculature surrounding it. The sciatic nerve and vascular structures are spared.

months after the initial trauma she was referred to our institution for evaluation and further management.

Physical exam revealed a 15 x 10 centimeter, firm, immobile mass in the medial aspect of the right thigh, very painful to examination, with no evidence of neurovascular compromise of the extremity. An MRI was obtained that showed an 11.9 x 9.1 x 4.5 centimeter mass in the proximal medial thigh with extension to the obturator foramen. She underwent wide surgical resection of the tumor. At surgery, a 20 x 16 x 9 centimeter encapsulated mass containing thick gelatinous gray material was found. The mass was adherent to the medial aspect of the hip joint capsule and to the obturator foramen. The resected specimen was sent for pathologic analysis and demonstrated a tumor with moderate cellular proliferation of spindle-shaped cells, extremely pleomorphic. The histological diagnosis was a leiomyosarcoma. The surgical procedure resolved the pain. The patient received postoperative radiation therapy and her recovery was good, without documented metastasis by the time of this writing.

Case 2

A healthy 44-year-old female suffered trauma to her left arm, falling on her outstretched hand while working. After an initial evaluation by her local physician she was diagnosed with a "muscle strain with a concomitant hematoma." The patient started physical therapy, however there was no improvement of her symptoms and she again consulted the physician a week later. An MRI was then ordered which showed a well-circumscribed mass not attached to the humerus along the lateral border of the left biceps brachii muscle, measuring 14.5 x 6.5 x 5 centimeters, with an intermediate signal in T1, and a high signal in T2. The radiologist and the attending physician interpreted the MRI as a muscular hematoma. Conservative care was ordered with continued physical therapy.

Six months after the traumatic episode she had no improvement, and the patient was referred to an orthopedic surgeon in another institution for evaluation. A new MRI was interpreted as being compatible with a soft-tissue sarcoma, and the patient was referred for treatment to our institution.

When the patient arrived, she presented with mild pain in her left upper arm, with numbness in the hand when outstretched. The physical examination showed a 15 centimeter, firm, non-tender soft-tissue mass in the left upper arm along the biceps muscle that adhered to the subcutaneous tissue. The motor and sensory functions of the left upper extremity were normal. We performed a wide excisional biopsy and found a well-circumscribed soft-tissue mass located in the left biceps brachii muscle. The pathology sections showed a high-grade sarcoma with a fine vascular background. After the surgical resection, the patient recovered well and received radiation therapy with no relapses or documented metastases at the time this report was made.

Case 3

A 33-year-old male, without previous relevant medical or surgical history, kicked a vehicle with his left lower extremity and developed mild pain in his left thigh. Five months later, without improvement in his

symptoms and after noticing swelling in his thigh, he consulted an orthopaedic surgeon. Based on the trauma history and minimal swelling with no other significant findings, the physician diagnosed an "adductor and hamstring muscular sprain." He also ordered an MRI that was performed three days later. The findings reported by the radiologist were of a 9 x 9.8 x 6.8 centimeter mass isointense to muscle in T1, hyperintense to muscle in T2-weighted signal, within the region of the adductor magnus with some extension into the adjacent biceps femoris, and some increased T2 signal within the vastus medialis. The radiologist also reported a hemorrhagic component to the lesion and areas of hemosiderin with low T1, low T2 signal characteristics. Based on the MRI images and the history of trauma the patient was referred to physical therapy, with ultrasound and massage.

Fifteen days later the patient returned with worsening in his symptoms and a new MRI was performed. At that time, the mass measured 11 x 11.9 centimeters and the radiologist reported the same previous findings, but recommended a biopsy since the MRI could not exclude aggressive sarcomatous lesions. The patient was then referred for treatment to our institution.

In the physical examination we found a very large, tender mass extending from the medial to the posterior aspect of the left thigh, along with left inguinal adenopathy. Gross sensory function distal to the knee was diminished. Vascular examination was normal. CT survey of the chest, abdomen and pelvis was performed and multiple soft-tissue nodules in the lungs and mediastinum were found. Subsequently an ultrasound-guided needle biopsy of the left thigh mass reported a poorly differentiated sarcoma. An excisional biopsy was then done with the diagnosis of a pleomorphic rhabdomyosarcoma. The patient started chemotherapy with four cycles of Adriamycin and cisplatin, with mild response. She was changed to a regimen of doxorubicin, ifosfamide, dicarbazine (DTIC) and mesna.

Seven months after the diagnosis a wide, limb-sparing resection of the tumor was performed. A large, encapsulated mass involving the medial and posterior compartment of the thigh was found along with severe compression of the sciatic nerve. The patient responded to chemotherapy, and at the time of this report the size of the lung metastases was subsiding.

DISCUSSION

Imaging provides the clinician with crucial information in the diagnosis, staging, treatment planning, treatment evaluation, and post-treatment assessment of patients with soft-tissue sarcoma.

Thanks to high-contrast tissue resolution and multiplanar imaging capability, MRI remains the gold standard for evaluation of most soft-tissues lesions. However, the sensitivity for diagnosis and grading remains controversial in the literature. MRI is not able to predict malignancy, and the findings commonly associated with malignant lesions frequently overlap with those seen in benign tumors.[4] Furthermore, a significant percentage of malignant lesions may appear deceptively benign with the currently used criteria.[9,10] MRI also performs poorly in the histological classification of soft-tissue tumors.[10] This is because MRI images provide only indirect information about tumor histology by showing signal intensities related to some physicochemical properties of the tumor components, and consequently reflect gross morphology of the lesion rather than underlying histology. Finally, the time-dependent changes of the tumors (as a consequence of intratumor necrosis and/or bleeding), makes the differentiation process even more difficult.

Differentiating between malignant and benign soft-tissue lesions has proven to be a difficult task even with the advantage of MRI. Soft-tissue tumors grow in a centrifugal manner until resistance is met. The barriers in soft tissues consist of major fibrous septa and the origins and insertions of muscles. Growth tends to occur in the plane of least resistance, which in soft-tissue tumors occurs in a longitudinal fashion (i.e., in the compartment of origin). The host responds to tumor growth by creating a reactive fibrovascular tissue that forms a limiting capsule in benign lesions. Aggressive lesions, however, compress the host reactive tissue into a pseudocapsule containing finger-like or nodular tumoral foci called satellite lesions. In highly aggressive lesions, tumoral foci (skip metastases) are found beyond the reactive zone within the compartment of origin.[3]

As we mentioned, MRI usefulness as a valid predictor of malignancy in soft-tissue lesions is debatable. However there are some individual parameters for predicting malignancy in MRI images: 1) Intensity and homogeneity of the MR signal on different pulse sequences; 2) High-signal intensity on T2-weighted images; and 3) Homogeneity on T1-weighted images. These are sensitive parameters but present with an unacceptably low specificity. Indeed, high-grade malignant soft-tissue tumors may show low-to-intermediate signal intensity on T2-weighted images because of an increased nucleocytoplasmic index and an altered cellular and interstitial components proportion, both resulting in a decrease of intra- and extra-cellular water.[1,2] Hermann et al. reported that changes in homogeneity (from homogeneous on T1- weighted images to heterogeneous on T2-weighted images) and the presence of low-signal intratumoral septations have a sensitivity of 72 and 80 percent and a specificity of 87 and 91 percent, respectively, in predicting malignancy.[7] Other signs

TABLE 1
Signal Intensities on T1- and T2-weighted Images

High signal intensity on T1-weighted images plus intermediate signal intensity on T2-weighted images	Lipoma Liposarcoma Lipoblastoma Hibernoma Elastofibroma Fibrolipohamartoma Metastasis of melanoma (melanin) Clear cell sarcoma (melanin)
High signal intensity on T1-weighted images plus high signal intensity on T2-weighted images	Hemangioma Lymphangioma Subacute hemangioma Small arteriovenous malformation
Low signal intensity on T1-weighted images plus high signal intensity on T2-weighted images	Cyst Myxoma Myxoid liposarcoma Sarcoma
Low to intermediate signal intensity on T1-weighted images plus low signal intensity on T2-weighted images	Desmoid and other fibromatoses Pigmented villonodular synovitis Morton's neuroma Fibrolipohamartoma Giant cell tumor of tendon sheath *Acute hematoma (few days)* *Old hematoma* Xanthoma High-flow arteriovenous malformation Mineralized mass Scar tissue Amyloidosis Granuloma annulare *High-grade malignancies*
Intermediate signal intensity on T1-weighted images plus high signal intensity on T2-weighted images	Neurogenic tumor Desmoid

related to malignancy include the presence of tumor necrosis, bone or neurovascular involvement, mean diameter of more than 66 millimeters, and irregular or partially irregular margins.[4] Finally, no predominant enhancement pattern is characteristic of benign or malignant lesions. Unfortunately, as deduced from the previous data, none of these parameters is reliable enough to precisely assess the benign or malignant condition of a lesion on MRI images.

MRI images of acute hematomas show low-to-intermediate signal intensity on T1, and low signal on T2. These same findings are seen in desmoids and other fibromatoses, pigmented villonodular synovitis, fibrolipohamartomas, giant cell tumors of the tendon sheath, xanthomas, high-flow arteriovenous malformations, mineralized masses, scar tissue, amyloidosis, granuloma annulare and high-grade sarcomas. Intratumoral hemorrhage is a rare finding that can be observed in benign and malignant lesions, and is difficult to differentiate from non-tumoral soft-tissue hematoma. Moulton et al.[11] evaluated 23 benign and 5 malignant tumors with hemorrhage in a total of 225 masses. Hemorrhage was diagnosed on the basis of high signal on T1-weighted images, coupled with low or high signal on T2-weighted images, provided the tissue was not isointense to fat in all sequences. A low-signal hemosiderin rim was interpreted as evidence of prior hemorrhage. In Table 1 we show the MRI image characteristics of some of the more common soft-tissue lesions and hematomas.

There are three reports in the literature of high-grade sarcomas mimicking hematomas in the extremities. Ogose et al.[12] reported an extra-skeletal Ewing sarcoma mimicking a traumatic hematoma in a 16-year-old boy with a history of recurrent hematoma in the thigh. Imaizumi et al.,[8] reported the cases of six patients with soft-tissue sarcomas who were diagnosed with traumatic hematomas. These lesions were characterized by rapid growth. Interestingly, the cytology of percutaneous aspiration was negative for malignancy in five of the six patients, and the final diagnosis was only made after an open biopsy several weeks later. Finally, Engel et al.,[6] reported on a young man who received trauma to his thigh that was initially diagnosed as an organizing hematoma of the adductor compartment. At surgery, evidence of a tumor was found that was histologically identified as a synovial sarcoma.

In their study[8], Imaizumi et al. retrospectively reviewed the history and imaging studies and concluded that MRI was a reliable diagnostic tool for the differentiation between hematoma and sarcoma. However, as presented in this report, the MRI images can be very similar in both pathologies, and high-grade soft-tissue sarcoma cases presenting after some degree of trauma could easily be mistaken initially as hematomas related to that recent injury.

We conclude that intramuscular hematomas following trauma should be approached with a high degree of clinical suspicion. MRI analysis can be used as an important diagnostic tool, but the results must be seen in the context of the clinical history. MRI is not sensitive or specific enough to rule out malignancy. The diagnosis of a high-grade sarcoma must be considered in these patients and any doubt should be resolved with a biopsy.

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